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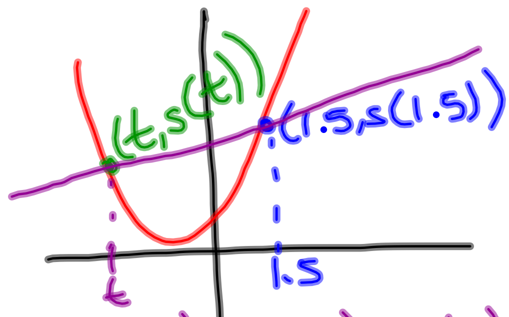
2.2 - 2.3 Limits

32) Let $s(t) = -16t^2+29t+6$

difference quotient

$$\lim_{t\to 1.5} \boxed{\frac{s(t)-s(1.5)}{t-1.5}}$$



$$\frac{s(t)-s(1.5)}{t-1.5} = \frac{s(1.5)-s(t)}{1.5-t}$$

$$= \lim_{t\to 1.5} \frac{(-16t^2+29t+6)-13.5}{t-1.5}$$

$$-16\left(\tfrac{3}{2}\right)^2+29\left(\tfrac{3}{2}\right)+6 = -36+\frac{87}{2}+6 = -\frac{60}{2}+\frac{87}{2} = \frac{27}{2} = 13.5$$

$$= \lim_{t\to 1.5} \frac{-16t^2+29t-7.5}{t-1.5} \approx \frac{0}{0}\text{ish}$$

IDK ⇒ cancel 0s

$$\begin{array}{r|l} & -16t+5 \\ \hline t-1.5 & -16t^2+29t-7.5 \\ & -(-16t^2+24t) \\ \hline & 5t-7.5 \\ & -(5t-7.5) \\ \hline & 0 \end{array}$$

$$\lim_{t\to 1.5} -16t+5 = -19$$

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36) Let $f(x) = \begin{cases} \frac{x^2-9}{x+3}, & x \neq -3 \\ \boxed{k} \text{ "}-6\text{"}, & x = -3 \end{cases}$

a) find k so that $f(-3) = \lim_{x \to -3} f(x)$

$$\lim_{x \to -3} \frac{x^2-9}{x+3} = \lim_{x \to -3} \frac{(x-3)\cancel{(x+3)}}{\cancel{(x+3)}} = \lim_{x \to -3} x-3 = \boxed{-6}$$

$k=-6$

b) with $k=-6$, show that $f(x)$ can be expressed as a polynomial

$$f(x) = \begin{cases} \frac{x^2-9}{x+3} = x-3, & \text{when } x \neq -3 \\ -6 = x-3, & \text{when } x = -3 \end{cases}$$

$f(x) = \boxed{x-3}$

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37b) $\lim_{x \to 0^+} \frac{1}{x} - \frac{1}{x^2} = \lim_{x \to 0^+} \frac{x}{x^2} - \frac{1}{x^2} = \lim_{x \to 0^+} \frac{x-1}{x^2}$

$\frac{\text{negative \#}}{0 \text{ ish}}$

$-\infty$

$\frac{2 \cdot 1}{2 \cdot 3} - \frac{1}{6} =$

$\frac{2}{6} - \frac{1}{6}$

$\boxed{37a}$ $\lim_{x \to 0^+} \frac{1}{x} - \frac{1}{x^2} = \lim_{x \to 0^+} \frac{1}{x} - \lim_{x \to 0^+} \frac{1}{x^2}$

$= \infty - \infty = 0$

what is wrong with this "calculation"?

"$\infty - \infty$" is an indeterminate form

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38) $\lim\limits_{x\to 0^-} \frac{1}{x}+\frac{1}{x^2} = \lim\limits_{x\to 0^-} \frac{x}{x^2}+\frac{1}{x^2} =$

$\lim\limits_{x\to 0^-} \frac{x+1}{x^2} \to +\infty$

~~DNE~~

2.2 - 2.3 Limits

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39) $\lim_{x\to 0} \frac{\sqrt{x+4}-2}{x} \cdot \frac{\sqrt{x+4}+2}{\sqrt{x+4}+2}$

$= \lim_{x\to 0} \frac{(x+4)-4}{x(\sqrt{x+4}+2)} = \lim_{x\to 0} \frac{x}{x(\sqrt{x+4}+2)}$

$= \lim_{x\to 0} \frac{1}{(\sqrt{x+4}+2)} = \frac{1}{4}$

$\frac{\sqrt{2}}{\sqrt{2}} \cdot \frac{2}{\sqrt{2}} = \sqrt{2}$?

$= \frac{2\sqrt{2}}{2} = \sqrt{2}$

$\frac{0}{0}$

$\frac{1}{0}$

$x-9 = (\sqrt{x}-3)(\sqrt{x}+3)$

$x = (\sqrt{x+4}-2)(\sqrt{x+4}+2)$

A term is just a group of 1 or more factors multiplied together

2.2 - 2.3 Limits

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40) $\lim_{x \to 0} \frac{\sqrt{x^2+4} - 2}{x}$

$= \lim_{x \to 0} \frac{(\sqrt{x^2+4} - 2)(\sqrt{x^2+4} + 2)}{x(\sqrt{x^2+4} + 2)}$

$= \lim_{x \to 0} \frac{x^2+4-4}{x(\sqrt{x^2+4} + 2)}$

$= \lim_{x \to 0} \frac{x^2}{x(\sqrt{x^2+4} + 2)}$

$= \lim_{x \to 0} \frac{x}{\sqrt{x^2+4} + 2} = \frac{0}{2+2} = \frac{0}{4}$

$= 0$

the "square root" thing

$\sqrt{x^2+4} = x+2$

x	LHS	RHS
0	2	2
1	$\sqrt{5}$	3
2	$\sqrt{8}$	4
	⋮	